

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2021-50

Matheus C. Carvalho (Referee)

Referee comment on "An analysis of the variability of $\delta^{13}\text{C}$ in macroalgae from the Gulf of California: indicative of carbon concentration mechanisms and isotope discrimination during carbon assimilation" by Roberto Velázquez-Ochoa et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-50-RC1>, 2021

This paper presents a large survey of macroalgal d^{13}C . The authors attempt to explain the wide variation in the observations by comparing d^{13}C with phylogenetic, morphological and environmental parameters.

Such kind of study is not novel, and it could be argued that the authors chose to perform a study that was doomed to failure, since it has been long known that macroalgal d^{13}C is widely variable due to many interplaying factors, and that simply collecting specimens from several different locations, albeit as many as they did, will in the end only once more confirm that this huge variability cannot be easily explained by a single factor alone. Because of that, there is a case to reject this paper.

On top of that, the paper is very poorly prepared. Some problems:

The authors did not take any care to write the paper in proper English. Some parts are still in Spanish (Tables 4 and 10).

Results are described in the methods (lines 215-227), parts of the result dealing with different topics are all mixed together (lines 301-306).

Abbreviations and definitions are not properly presented to the reader (what is GCE? What is R, C and O forms?).

The discussion needs that the figures or tables supporting the interpretations are linked to the text, otherwise it is impossible to evaluate the authors claims.

Statistics are very poorly presented throughout the results. For example, line 296-300; which test was used there to compare different groups? There is nothing. This is the rule through the results.

Many times the authors make affirmations without any support from literature. For example, line 478, where are the numbers for the conditions in GC waters? Line 485, who said that an efficient CCM helps productivity when the alga is growing under sub-optimal

conditions? Line 527, how is that that pCO₂ and temperature depend on light?

In summary, I SUGGEST REJECTION, because the paper is not novel and is very poorly prepared. Comments above are for re-work and maybe resubmission to another journal, but the lack of novelty may render all the effort useless.

On top of all that, the authors need to completely re-interpret their results. It is very clear that their approach is inefficient. All environmental factors influencing d13C are non-significant, and, when are, very weakly. The authors need to do a more rational analysis of their results.

Macroalgal d13C is actually two variables in one: DIC d13C plus fractionation. Part of the variability in their results is due to differences in DIC d13C. For example, when salinity changes, DIC d13C changes, and consequently macroalgal d13C changes as well. I believe the authors did not measure DIC d13C (if they did, they should definitely include these data, it would make a mediocre paper become a great paper). But, for most of their samples, DIC d13C will probably be very uniform, so most variation in macroalgal d13C will probably reflect fractionation. Fractionation in macroalgae is largely influenced by photosynthetic rates. So, the authors should reframe their discussion taking photosynthetic rates into consideration, possibly as the main consideration. Therefore, the authors should re-interpret their results using what is currently known about fractionation, and, if they can, about DIC d13C. If they don't have DIC d13C data, they can at least estimate probable values using historical data for the geographical region, taking into consideration seasonal variation, and, importantly, rain parameters, as the main factor here will be seawater and freshwater mixing.

Some must-read papers:

[1] M.C. Carvalho, K. Hayashizaki, H. Ogawa, Short-term measurement of carbon stable isotope discrimination in photosynthesis and respiration by aquatic macrophytes, with marine macroalgal examples. *Journal of Phycology*, 45, 761-770 (2009).

[2] M.C. Carvalho, K. Hayashizaki, H. Ogawa, Effect of pH on the carbon stable isotope fractionation in photosynthesis by the kelp *Undaria pinnatifida*. *Coastal Marine Science*, 34, 134-139 (2010).

[3] M.C. Carvalho, K. Hayashizaki, H. Ogawa, Temperature effect on carbon isotopic discrimination by *Undaria pinnatifida* (Phaeophyta) in a closed experimental system. *Journal of Phycology*, 46, 1180-1186 (2010).

[4] M.C. Carvalho, K. Hayashizaki, H. Ogawa, Carbon stable isotope discrimination: a possible growth index for the kelp *Undaria pinnatifida*. *Mar. Ecol. Prog. Ser.*, 381, 71-82 (2009).